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DIGITAL INCLUSION AMONG OLDER ADULTS: IDENTIFYING POTENTIAL SOLUTIONS

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Abstract: *Technology could assist older adults in managing their lives independently, yet many face challenges in using it. This article explores solutions from the perspective of older adults to address the challenges. A qualitative research approach was used, featuring 15 semi-structured interviews with individuals aged 65 or above. Data was analysed thematically. Findings indicated the effective role of education in supporting older adults' digital inclusion by supporting their digital skills, self-efficacy, and fostering positive emotions toward technology. Real-time support provided by assistive technology like chatbots for non-critical online tasks emerged as useful for maintaining older adults' engagement with technology. Additionally, user-friendly designs of smart devices and e-services with clear instructions were identified as essential. Furthermore, our findings underscore the need to identify different motivational factors to encourage a broad range of older adults and realign fair social norms to foster technology use within this demographic.*

Keywords: *smart devices and e-services, older adults, digital divide, digital inclusion.*

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INTRODUCTION

The global population age structure is undergoing a significant shift, with older adults, individuals aged 65 and above, representing an increasingly large share of the total population (Coco, Kangasniemi, & Rantanen, 2018; Valkama & Oulasvirta, 2021). In Europe, the proportion of older adults will reach 25% of the total population by 2030 and 30% by 2070 (European Commission, 2021). This rapid increase is because of different factors, such as declining fertility rates and rising life expectancy (Welsh, Matthews, & Jagger, 2023).

Population aging is a prominent socioeconomic trend with many implications (Bloom & Luca, 2016; Coco, Kangasniemi, & Rantanen, 2018; Valkama & Oulasvirta, 2021). The shift in demographics toward aging leads to a lower rate of participation in the labor force while it increases healthcare costs and strains pension and health schemes leading to slow economic growth (Bloom & Luca, 2016). In addition, older adults face many age-related health difficulties, such as physical disabilities or cognitive issues, that undermine their independence and autonomy in managing self-care (Huisman, Kunst, & Mackenbach, 2003; Kontos, Blake, Chou, & Prestin, 2014). An example is facing challenges in using the healthcare system to manage their health issues independently (Bertolazzi, Quaglia, & Bongelli, 2024; Van Het Bolscher-Niehuis, Den Ouden, De Vocht, & Francke, 2016). Therefore, older adults need to be taken care of by others (Pulkki & Tynkkynen, 2016). This means that the number of people requiring extended care will likely increase. Given the shortage of carers and nurses, it is necessary to find solutions to assist older adults (European Parliament Technology Assessment, 2019).

One solution to mitigate the effects of population aging could be the use of technology, which can support and streamline many day-to-day activities and assist older adults in managing their daily tasks, thus improving their quality of life (Bloom & Luca, 2016; Pal, Funilkul, Vanijja, & Papasratorn, 2018; Rosenberg & Taipale, 2022; Vaportzis, Giatsi Clausen, & Gow, 2017). The usefulness of technology for older adults has been studied in different contexts. For example, Thangavel, Memedi, and Hedström (2022) showed that using information and communication technology can facilitate older adults' communication and reduce their loneliness, for example, via social media. Furthermore, Huvila et al. (2018) discussed the role of technology in enhancing older adults' access to information.

Lefler et al. (2018) studied the usefulness of technology for older adults in the health domain. They showed that *mHealth*, defined as using mobile phones and other wireless tools for medical purposes (Istepanian & Lacal, 2003), supported older adults in maintaining their health and adhering to their treatment regimens. Additionally, Wang et al. (2019) found that technology supported aging in place, staying in one's home, and having an independent lifestyle. This was possible because technology facilitated older adults' home-based tasks, such as cooking and cleaning, and satisfied their critical needs, such as maintaining social connections and personal health (Pal et al., 2018).

Despite these benefits, some older adults face difficulties restricting their use of smart devices and e-services. A *smart device* can be variously defined. According to Silverio-Fernández, Renukappa, and Suresh (2018, p.8), it is "a context-aware electronic device capable of performing autonomous computing and connecting to other devices through wires or wirelessly for data exchange". Two examples are smartphones and computers.

For older adults, then, one difficulty could be related to the lack of *digital literacy*—that is, individuals' awareness of, attitudes toward, and ability to use technology (Reddy, Sharma, & Chaudhary, 2020). This lack makes it difficult for them to gain experience and comfort from technology (Schreurs, Quan-Haase, & Martin, 2017). Additionally, Wildenbos, Peute, and Jaspers (2018) showed that the design of smart devices and e-services is not always suitable for older adults; the design guidelines often do not consider their functional limitations. For instance, a complex design makes it difficult for some older adults to navigate e-services, such as returning to the previous interface (Ejdys & Gulc, 2022; Hoehle, Aljafari, & Venkatesh, 2016; Schreurs et al., 2017). They might face privacy and security concerns (Spann & Stewart, 2018; Turner, Turner, & Van De Walle, 2007). Certain e-services require the provision of personal information, and in some cases, older adults are wary of sharing such information (Lie, Lindsay, & Brittain, 2016).

Furthermore, some older adults might not be motivated to use technology for various reasons, such as difficulties in achieving personal goals or being uncomfortable with a shift in responsibilities from experts to individuals (Airola, 2021). In addition, Suopajärvi (2015) found that some older adults did not perceive technology as sufficiently useful or worthwhile to justify investing their time in learning and using it.

These challenges can disconnect some older adults from digital life, leading to a *digital divide* (Tacken, Marcellini, Mollenkopf, Ruoppila, & Széman, 2005), where there are significant inequities between a person's access to and ability to use and benefit from technology (Fuchs & Horak, 2008). As technology is increasingly present in public and private life, some older adults might become isolated from the rest of society (Tirado-Morueta, Rodríguez-Martín, Álvarez-Arregui, Ortíz-Sobrino, & Aguaded-Gómez, 2023). For example, they might not be able to rely on *eHealth services* (Mannheim et al., 2019), which is "the use of information and communication technologies for health" (World Health Organization, 2018), leading to unequal use of available healthcare services.

In a transition toward a sustainable society where everyone has an equal chance to use technology, it is necessary to find solutions that support older adults' digital inclusion. The concept of *digital inclusion* can be understood from various perspectives. In this study, this concept refers to the degree to which older adults can engage with a digitalizing society using smart devices and e-services (Hänninen et al., 2021). Digital inclusion varies in non-linear ways across lifespans (Taipale, Wilska, & Gilleard, 2017). To support digital inclusion among older adults, scholars have identified several solutions. For example, Mannheim et al. (2019) showed the usefulness of considering older adults' needs, characteristics, expectations, and experiences in the design of smart devices and e-services. The design should be tailored to address the situated and dynamic needs and interests of older adults (Righi, Sayago, & Blat, 2017). In addition, Righi et al. (2017) noted the importance of improving the *usability* of smart devices and e-services, the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO-9241-11, 2022), to support older adults' digital inclusion.

Providing older adults with the necessary support services, such as digital skills, has been identified as effective in supporting their digital inclusion and use of smart devices and e-services in many studies (Jokisch, Schmidt, Doh, Marquard, & Wahl, 2020; Kärnä et al., 2022; Pihlainen, Korjonen-Kuusipuro, & Kärnä, 2021; Tirado-Morueta et al., 2023). Despite

the availability of multiple solutions, some older adults still face many challenges in interacting with smart devices and e-services and might remain non-users. Therefore, there is a need to find other practical solutions from the perspective of older adults, specifically where technological development is progressing quickly (De Santis et al., 2023; Gomez-Hernandez, Ferre, Moral, Villalba-Mora, 2023; Hoehle et al., 2016; Fang et al., 2018; Li & Luximon, 2016; Wildenbos et al., 2018; Zhou, Qian, & Kaner, 2024).

This study aimed to identify potential solutions to tackle the challenges hindering older adults' sustained use of smart devices and e-services. Fifteen semi-structured interviews were conducted with adults aged 65 or above who had previous experiences using smart devices or e-services. This approach allowed us to obtain practical results. The study sought to answer one main research question: *What suggestions do older adults recommend to address their challenges with smart devices and e-services?*

Older Adults and Digital Inclusion

Digital inclusion has the potential to bridge the digital divide and mitigate the social exclusion experienced by disadvantaged segments of society, such as older adults (Hill, Betts, & Gardner, 2015; Wong, Law, Fung, & Lam, 2009). Promoting digital inclusion among older adults is a key objective in many European countries. To achieve this goal successfully, it is essential to emphasize that digital inclusion involves more than merely increasing access to smart devices and the Internet. It also requires ensuring that individuals possess the necessary digital skills and feel confident and empowered to use smart devices and e-services effectively (Tirado-Morueta et al., 2021; Wynia Baluk, Detlor, La Rose, & Alfaro-Laganse, 2023). In addition, these tools should provide valuable and relevant content tailored to specific disadvantaged groups to enhance their motivation and incentives to learn and use it (Wong et al., 2009). Furthermore, according to Rasi-Heikkinen and Doh (2023), to support digital inclusion among older adults, policies, practices, and research projects should be implemented to promote, examine, and assess older adults' participation in a digitalized society.

Hanson (2011) showed that older adults interact with technology only if their multifaceted needs, including physiological, societal, and personal ones, are satisfied by it. Various factors were identified as useful in influencing older adults' digital inclusion, including demographics, perceived difficulty, cost of access, privacy concerns, trust, and others. While these factors are often considered significant, there is no consensus on the list of factors that influence older adults' digital inclusion (Guner & Acarturk, 2020).

Several frameworks and theories have been used to understand potential factors that support individuals' digital inclusion, for instance, the technology acceptance model (TAM) proposed by Davis (1989). This theory suggests that technology use is driven by behavioral intention, which is shaped by an individual's attitude toward the technology. It further explains that both attitude and behavioral intention are influenced by perceived usefulness and perceived ease of use, alongside external factors. Based on TAM, if individuals perceive a technology as both useful and easy to use, they are more likely to use it.

Moreover, the Unified Theory of Acceptance and Use of Technology (UTAUT) aims to provide a unified understanding of digital inclusion and shows that use behavior could be an outcome of the relationship between background characteristics and behavioral intention

(Venkatesh, Morris, Davis, & Davis, 2003). UTAUT identifies four key factors: individual's belief that technology will assist them in completing tasks, their perceived ease of learning, their perception of societal value placed on learning technology, and the availability of genuine support during the learning process. In addition, UTAUT considers the four moderators of age, gender, experience, and voluntariness which are related to predicting behavioral intention to use technology (Venkatesh, Thong, & Xu, 2016). The extended version of UTAUT, known as UTAUT2, adapts the original model from an organizational context to consumer use. This development involves adding three additional constructs—hedonic motivation, price value, and habit—to the core framework (Plohl & Babič, 2024; Venkatesh, Thong, & Xu, 2012). Hedonic motivation is defined as enjoyment or pleasure gained from using technology. Price value represents the consumer's cognitive evaluation of the tradeoff between the perceived benefits of using the technology and its monetary cost. Habit reflects the degree to which an individual perceives their technology use behaviour as automatic (Venkatesh et al., 2012). Various studies have used this framework in the field of digital inclusion among older adults (e.g. Palas, Sorwar, Hoque, & Sivabalan, 2022; Tiainen, Kaapu, & Ellman, 2013).

METHODS

This study sought to find solutions to facilitate the sustained use of smart devices and e-services by older adults with prior experience with these tools. It applied a qualitative, exploratory approach based on in-depth, semi-structured, face-to-face interviews with individuals aged 65 years or above.

Recruitment of Participants

People were eligible to participate if they were aged 65 years or older and had experience using at least one smart device or e-service. The participants were restricted to experienced older adults to ensure that they had initial familiarity with the topic, had encountered challenges related to the technology in question, and could suggest practical solutions. We excluded individuals with dementia and those who were too frail or ill to take part.

Participants were recruited through convenience sampling at the main public library in Turku, southwest Finland. The researchers advertised the study and explained its aims to older adults visiting the library from June to August 2022. In addition, we used flyers to advertise the study to the target group. Individuals interested in participating shared their contact details with the researchers. Later, the first author contacted them to inquire about their interest in participating and choose an interview time and place. Two individuals who were initially interested in participating did not answer their phones, and another one refused to take part for personal reasons.

The study followed the procedures and codes of conduct of the Finnish National Board for Research Integrity TENK guidelines (2019). Participation was completely voluntary, and the researchers obtained informed consent from all the participants before the interviews took place. This study did not collect any personal or sensitive information and did not endanger the health and safety of the participants. The data were stored following the EU’s General

Data Protection Regulation (2019). The participants were not reimbursed for their participation.

Data Collection

The researchers developed a semi-structured interview guide to collect data (Additional file 1). Before the interviews, we provided the participants with an oral introduction to the study, including its aims, data collection process, and security and privacy aspects of the collected data. In addition, the participants were told about the definition of smart devices and e-services and given concrete examples. To ensure clarity, the participants were provided with a written information sheet.

We collected information about the participants' backgrounds, including their gender, education, and the smart devices they used. We also asked them what kind of experiences they had concerning the use of smart devices and e-services, what could prevent them from benefiting from smart devices and e-services, and what suggestions they had to be able to benefit more from these tools. To ensure the interview guide's effectiveness, we conducted pilot interviews with two older adults. Since no major revisions were necessary, with the participants' consent, we included the pilot interviews in the study.

All the interviews were carried out in person, and they took place in Turku's main public library from June to August 2022. The interviews were conducted in Finnish. With the permission of the participants, they were audio-recorded. After each interview, the audio files were transcribed and translated into English by a transcription company; then, the files were deleted. Any identifying information was removed. The text files were used solely for research purposes and were not shared with other parties.

The average duration of the interviews was about 45 minutes (range 25–75 minutes). We continued interviewing until we reached saturation—that is, sufficient data to answer the study's research questions (Saunders et al., 2018).

Data Analysis

Thematic analysis involves a series of steps aiming to identify recurring themes or patterns within a textual dataset. To analyse the data, we applied the six steps of the thematic analysis framework introduced by Braun and Clarke (2006):

Step one is familiarizing oneself with the data by transcribing, reading the transcripts repeatedly, and noting the initial list of ideas. To follow the framework, we transcribed interviews and read the transcripts several times, each reading circle led us to note down our initial ideas.

Step two is generating initial codes. Getting familiar with the data makes it possible to identify initial codes. The initial codes should identify interesting features of the data systematically. This step can have either theory-driven or data-driven approaches. We selected the data-driven approach and worked systematically through the entire dataset paying full and equal attention to each data item. Then we identified as many possible interesting aspects in the data items, and codes, that may form the basis of potential themes across the dataset.

Step three is searching for themes. After finalizing the initial coding process, the analysis proceeds to search for potential themes and sub-themes. This step focuses on considering how different codes may combine into potential themes and sub-themes and have a sense of the significance of individual themes. In this step, visual representations, such as tables or mind maps (drawings) can be used to sort the different codes into the potential themes and sub-themes. We combined the identified codes into the potential themes and sub-themes. For visual representation, we used tables.

Step four is to review and refine the potential themes. This process might lead to the understanding that some potential themes are not relevant to the research questions, some could be combined into broader ideas, or some need to be divided into separate themes. In this step, it is necessary to ensure that there is a clear coherence of data within themes and equally distinct boundaries between themes. At this level, two processes of evaluating whether the identified codes make up a particular theme fit together and assessing whether the themes as a whole capture the entire dataset. We reviewed and refined the identified potential themes resulting in having relevant and suitable themes that capture the entire dataset.

Step fifth is defining and naming themes. At this step, we defined and further refined the themes that we presented and analyzed the data within them. The main job in this step was to identify the central idea in each theme and name them in a way that concisely captures that idea.

Step six is producing a scholarly report of the analysis when themes and their interrelationships are fully identified. The analysis must provide a concise, coherent, logical, non-repetitive and interesting story of data, within and across themes. At this step, we ensured the analysis was relevant to the research questions and literature, and we reported the findings in the results sections.

RESULTS

Demographic Information

The ages of the participants ranged from 67 to 94, with an average age of 83. The participants' characteristics are summarized in Table 1.

Table 1. Respondents' Characteristics (N = 15)

Characteristic		N (%)
Gender	Male	6 (40)
	Female	9 (60)
Educational background	Elementary education	3 (20)
	Upper secondary education	3 (20)
	Bachelor's degree	2 (13,33)
	Master's degree or higher	7 (46,66)
Smart devices used by the participants	Smartphone	13 (86,66)
	Simple phone	2 (13,33)
	Tablet	8 (53,33)
	Computer/ laptop	9 (60)
	Other devices	10 (66,66)
	Internet connection	13 (86,66)

Reasons for using smart devices and e-services	Communication	15 (100)
	Entertainment	9 (60)
	Information seeking	8 (53,33)
	Daily tasks (e.g. banking affairs or online shopping)	7 (46,66)

Solutions to Address the Challenges of Using Smart Devices and E-services.

This study identified several solutions to address the challenges that older adults might face while using smart devices and e-services. These solutions are categorized in Table 2 and explained in the following section.

Table 2: Solutions, Suggested by Older Adults, to Address Their Challenges with Smart Devices and E-services.

Solutions	Potential Challenges to Address
Providing support services	Lack of digital skills or insufficient digital skills
	Lack of familiarity with the available support services
	Lack of proper support services
	Negative attitudes
	The belief that smart devices and e-services are not designed for older adults
Supporting self-efficacy	The concern about damaging advanced smart devices.
	The belief that smart devices and e-services are not designed for older adults
	Stress or anxiety
	Negative attitudes
Providing proper instruction	Lack of instruction
	Complexity of the available instructions
Providing assistive technologies	Lack of real-time support
	Cognitive issues (e.g. memory issues)
	Fear of making serious mistakes
	Stress or anxiety
Providing user-friendly smart devices and e-services	Complexity of the smart devices or e-services
	Lack of proper English language skills
	Frequent updates
	Health issues
Supporting motivation	Personal perceptions and mindsets
	Missing in-person interactions
Setting fair social expectations	The belief that smart devices and e-services are not designed for older adults

Providing Support Services

Several participants, regardless of their educational backgrounds, acknowledged that deficiencies in their digital skills limited their digital inclusion. These interviewees said that their digital skills allowed them to use simple smart devices and e-services and only for basic tasks, such as making a phone call or being active on social media, but not for more advanced functions (e.g. file compression) or important tasks (e.g. managing health or financial issues).

"I have experience working with computers, but I would say that I can't do many things. An easy example is that I can write an email, but I don't know how to upload big files" (P12). Differences in participants' digital skills were noticed. Some participants said that they were able to use smart devices and e-services completely fluently and without the need for external help.

Lack of sufficient digital skills was identified as a source of negative emotions for some participants. They shared that their insufficient digital skills led to negative emotions regarding technology or themselves. They felt incapable and stupid. These feelings were said to discourage them from using smart devices and e-services. "*I don't have enough knowledge to use computers, and it makes me have bad feelings about myself when I have to use these tools."* (P8)

Some participants talked about their challenges when they wanted to gain digital skills or update their knowledge. Some of these interviewees noted they were not aware of the available support services and could not find any relevant information. Some noted that there was no support services close to their living area so they had to travel to get help. Some others said that even though they had a chance to use the support services; the services were not proper for their age group or tailored to their needs.

> *There was a course in the main library in Turku on how to use computers. I was there, and I learned some things, but the course could have been better. The teacher was very young, and she was teaching quickly. Maybe she had no idea how hard it was for us to follow her. She shared too much information, which was hard to learn and remember.* (P13)

One solution, suggested by most participants to address the above-mentioned issues, was providing older adults with proper education. The education, it was said, could be provided in groups or individually; however, most participants, especially those with low educational backgrounds or less experience with technology, expressed a preference for personalized tutoring in their homes using their own smart devices. The interviewees believed that learning in a familiar environment with familiar smart devices facilitates their learning and helps them retain information better. These participants described that memory issues make it difficult to recall details or apply the lessons learned with other tools to their own. "*I don't know how to use my computer. I wish someone just comes and teaches me at home. If I learn with my computer, I will remember for the next time.*" (P12)

The same participants noted also the potential benefits of repeating the training more than two times to ensure they had learned the important knowledge. In addition, they talked about the importance of having a teacher of a similar age, as they believed that peer tutoring could foster mutual understanding, be more reliable and trustworthy, and enhance the quality of the training. "*I trust a teacher more when they are my age; we understand each other better*." (P12)

Some participants emphasized the importance of support from compassionate experts, such as family members. For example, three individuals talked about using certain e-services, such as My Kanta, the nationwide e-health record system, just because their spouse or children taught them to use the services. "*My wife said I should use My Kanta to check my health records. I was not so sure if I could do it. But she helped me."* (P8)

Supporting Self-efficacy

The results of the current study identified several problems stemming from a lack of self-efficacy. For example, some participants, especially females and those with low educational backgrounds were afraid of touching smart devices and causing damage to them, especially when the devices were unfamiliar and seemed very advanced or fragile. Therefore, they preferred to minimize their interaction with the devices to reduce the likelihood of causing damage and embarrassing themselves. In addition, some noted that the complexity of the smart devices or e-services made them believe that these tools were not designed for people of their generation, and they were not supposed to use such tools. Thus, they were reluctant to use those smart devices and e-services.

> *These computers are so hard to work with them. I know young people love these devices, but I think that these devices are not for people of my age. I only have a simple phone and use it to call people.* (P4)

Most participants suggested that supporting older adults' self-efficacy would help them believe in their abilities and create the mindset that they can and should use smart devices and e-services even if the tools initially seemed so hard to learn and use. The interviewees recommended several solutions, for example, they believed supporting digital skills via education could increase older adults' confidence in using smart devices and e-services and cultivate positive attitudes toward technology and themselves. For example, one participant stated, "*My son taught me to use mobile banking. I was able to pay my bills, and I felt good about myself.*" (P3)

In addition, it was noted that the availability of support services could promote the idea that people with different backgrounds (e.g. age, education, etc.) could learn and use such tools. Some participants saw peer tutoring as useful in supporting their self-efficacy. They believed that seeing people at their age who mastered using smart devices or e-services gives them the courage to use these tools.

Moreover, providing feedback was recommended by some participants as another solution supporting older adults' self-efficacy. The interviewees said that they would feel happy to receive feedback either automatically or from specific people. For example, an automatic positive message appears on the page when an online task is completed successfully. *"Imagine a bank application that knows the age of its users. For instance, if I, a user over 65, complete a task, like paying a bill, the app could display a message saying, 'Well done! This message could encourage me to use this app again or try other apps."* Moreover, some participants said that positive feedback from real people could emotionally support their self-efficacy. "*I paid all the bills online by myself and my son said that you have done a great job; I was encouraged to do other online tasks."* (P)

Providing Proper Instructions

Some participants highlighted challenges related to the instructions provided for smart devices and e-services. Some interviewees noted the complete absence of clear, accessible instructions, which increased their sense of complexity and frustration when using smart devices and e-services. Others pointed out that even when instructions were available, they were often riddled with technical jargon or presented in formats unsuitable for individuals

with physical disabilities, for instance, small fonts that posed significant difficulties for those with vision impairments.

These barriers were said to impede the participants from setting up and navigating smart devices or e-services independently. Moreover, they found it challenging to rely on such instructions to troubleshoot problems during use, further exacerbating their difficulties.

> *I have a blood pressure issue, and sometimes I need to measure my blood pressure at home. When I need to use the device, I often forget which button to press. My device has three buttons. The instructions are written with small characters, which is difficult for me to read. So, I have to ask others to read it for me.* (P10)

To address the challenges associated with instructions, some participants shared several valuable insights. The interviewees emphasized the importance of simple, step-by-step guidance that could serve as a clear roadmap for older adults when they want to complete online tasks or operate smart devices. The interviewee highlighted that the guidance should be free of charge, as most smart devices are already expensive, and charging extra for instructions would be unreasonable.

Participants also stressed that the instructions should use plain, easy-to-understand language, avoiding technical jargon to ensure its usefulness for all user groups. Additionally, they suggested that the instructions be available in multiple languages, enabling users to access them in their native language. For more complex smart devices or sensitive e-services, such as those related to health or financial matters, participants preferred to have instructions in visual or audio formats. Examples included videos, audio recordings, and illustrative figures accompanying text-based instructions. These multimedia formats were seen as particularly helpful for older adults, as they provide reassurance, reduce stress, and ensure tasks are performed correctly.

> *The printer broke. I found the instructions and was able to install what was necessary. It was less stressful to fix it by following the instructions. I believe the instructions should be simpler and follow a road map*. (P13).

Providing Assistive Technology

Some participants raised the issue of lacking real-time support while using smart devices or e-services. These participants noted that forgetting certain details caused them to feel stressed or nervous when using a smart device or completing an online task, and they could not get any real-time support. Their anxiety stemmed from a fear of making irreversible mistakes with potentially serious and long-term consequences. They said that this challenge mostly stopped them from completing their online tasks or using smart devices.

> *Many times, I was in the middle of completing an online task and forgot what to do as the next step. So, I had to stop before finalizing my task."* (P6)
>
> *It was a couple of days ago. I wanted to check something on a bank account. I clicked on a link, but then I was on a different page. I did not know what this page was, and I was afraid of clicking on anything. I could have done something wrong. I just closed the web page.* (P5)

Some interviewees, regardless of their educational backgrounds, spoke of the importance of receiving real-time support for their sustained use of smart devices and e-services. These interviewees suggested several options, such as phone support, voice commands, and

chatbots. They found chatbots useful for mitigating their stress and fear and helping them recall details and complete their online task. However, they mentioned trusting chatbots only for nonserious issues. In case of serious or complicated issues, such as health or financial-related topics they prefer to have at least a phone call with a real person. These participants, in addition, highlighted the value of visual tours as a form of real-time support for explaining new e-service features and functionalities.

> *I was booking a hotel for my trip, and then I forgot what I needed to do next. I was so nervous. I wished there was a button I could press to get help from a chatbot. I could tell the chatbot what I needed or why I was stuck, and it could guide me. I think a chatbot wouldn't hurt, as long as it doesn't have access to my bank account*. (P10)

Providing User-friendly Smart Devices and E-services

The complexity of the available smart devices and e-services and their constant updates were raised by some participants as one of their primary concerns, regardless of their educational backgrounds. They felt that most smart devices and e-services had inappropriate and intricate interface designs, resulting in challenging and time-consuming interactions. The most frequently mentioned issue was related to navigation difficulties, and the participants shared many problems they faced. For example, they said that many web pages were overloaded with information, making it challenging to locate what they needed. They also found it difficult to distinguish clickable elements from non-clickable ones, and even when they found the clickable element, it often opened a new page full of text, further complicating the search process.

Furthermore, some interviewees reported that the development of smart devices and e-services was so fast that keeping up with the changes was difficult. They considered themselves slow adopters of new technologies and mentioned getting bored easily or forgetting the details fast when they aim to learn updates. Some interviewees said their unfamiliarity with the English language or technical terminologies added to their perceived difficulty with smart devices and e-services.

Some participants shared several ideas for supporting the usability of smart devices and e-services. For example, they suggested producing lighter versions of smart devices. Older adults might not be strong enough to carry heavy gadgets, or their shaky hands cause them problems holding normal gadgets. "*Using a tablet is more comfortable than a computer or a phone, but if the tablets were lighter, I could hold them longer and use them more.*" (P6).

Some interviewees suggested increasing the size of some buttons on phones' keyboards, such as the microphone button. The participants said that their main reason for using smart devices was communication, this function could facilitate it, especially for those with physical difficulties, such as shaky hands and visual impairments. Moreover, some participants suggested using facial recognition as a password mechanism for social media apps instead of traditional text-based passwords, as it was so hard for some of our interviewees to remember passwords due to their cognitive issues.

> *I created an Instagram account a couple of years ago, but I deleted the app. Later, when I decided to use it again, it asked for my password, and I couldn't remember it. It would be better if social media accounts used facial recognition as a password [mechanism]. It would be easier and safer.* (P11)

Regarding e-services, some interviewees recommended using bright colors for the backgrounds of web pages, noting that text is easier to read when the background has white or other light colors. Moreover, some participants suggested developing and following a color code for national important online platforms, such as patient portals or bank applications to facilitate the search process. For example, they recommended that clickable items be bolded with green color.

Supporting Motivation

Lack of motivation could stop older adults from using smart devices and e-services. Some interviewees said that using these tools was difficult, and they felt disappointed after spending many hours struggling with them. The sense of imbalance between the effort expended and the results achieved discouraged them from continuing to use smart devices or e-services.

> *I used computers for a while and managed to send emails and pay my bills. But I couldn't do many things even after spending so much time and energy. I was so disappointed in myself and didn't see enough reasons for my struggles. One day, I woke up and said, "No more computers." Since that day, I have only used my phone to call people.* (P15)

In addition, the participants shared their worries that digital-based communication, such as video calls, might replace human-based interaction. This worry had many negative consequences. First, the interviewees believed that if people met virtually, they would not be motivated to meet in person, especially young people. This perception generated negative feelings and reduced the interviewees' motivation to continue using smart devices and e-services because they wanted to continue meeting their children or relatives in person. Second, the interviewees assumed that when everything is online, many roles might shift, and they have to take on many responsibilities. For example, if they have to manage their finance online and there is no real person to guide them, it causes stress and discouragement.

Some interviewees spoke of the importance of motivation in supporting older adults' willingness to continue using smart devices or e-services. We found that the meaning of "motivation" varied from one person to another. For example, some participants with low educational backgrounds believed that they needed reminders concerning the benefits of smart devices and e-services, while some reported their need for emotional and digital support.

Furthermore, some interviewees, especially those with high educational backgrounds, shared the role of peers in encouraging their use of smart devices and e-services. It was noted by some interviewees that they might continue to use a smart device or an e-service if their friends were also using it. "*I have a Facebook account, which I used years ago. Then, I stopped. When a couple of friends said that they were using the app and texting each other, I started using it again*" (P1).

Setting Fair Social Expectations

Our findings showed that social expectations could have both positive and negative effects on older adults' use of smart devices and e-services. Social expectations could act as either a

barrier or a motivator, depending on how they are perceived and managed. On the one hand, according to some participants, social expectations served as a hindrance. The participants shared experiences of feeling pressured to learn new technologies quickly. Such unrealistic expectations discouraged them and made the learning process stressful.

> *"When I asked my kids to teach me how to use mobile banking, they were teaching me and kept asking, 'Don't you get it?' They expected me to learn it immediately. It doesn't work that way for me—we [older adults] need more time, practice, and a patient teacher."*

In addition, some participants shared the social impression of being underestimated. *"If you can't do it, let it be, I will do it for you"* (C12). This behavior shamed and demotivated older people and made them feel that they had to give up before trying enough.

On the other hand, some participants saw that social expectations acted as a motivator. Several participants highlighted how these expectations supported their digital inclusion. They noted that feeling expected to perform online tasks independently, such as managing bills created a sense of responsibility and drive to learn. In these cases, the desire to meet expectations from close or extended social networks provided a meaningful push toward digital inclusion. *"I knew my kids expected me to pay my bills online, so making them happy was one reason I learned"* (P5).

Furthermore, interviewees believed that reasonable social expectations could convey a message that these services are designed for everyone and encourage them to use these tools. This expectation could address common stereotypes, such as "Not designed for me", or "I am too old to learn and use smart devices and e-services."

Our participants believed that fostering digital inclusion among older adults requires setting fair and realistic expectations that account for their learning capabilities. Support, guidance and encouragement were suggested to help transform these expectations into positive motivators for successful digital inclusion.

DISCUSSION

This article presents findings from a qualitative study involving 15 semi-structured interviews with individuals aged 65 years and above who had experience using smart devices and e-services. We identified practical solutions to address the challenges some older adults often face when using these tools to support their sustained use. Implementing the identified solutions in practice requires collaboration among various parties, including societal stakeholders, authorities, service developers, caregivers, and others.

One significant useful solution identified in the analysis, is providing older adults with support services to use the available smart devices and e-services. The services should aim to support older adults' digital skills and help them understand smart devices and e-services as well as the relevant updates. The usefulness of education has been identified in many other studies (Berkowsky & Czaja, 2018; Jokisch et al., 2020; Rantanen, Järveläinen, & Leppälahti, 2022). Suopajärvi (2015) argued that supporting older adults' digital skills, among other citizens, is essential especially when the technology is aimed at the public. We add to these findings that personalized tutoring delivered at home with tools owned by older adults could have better learning outcomes than public courses with borrowed tools.

Possessing sufficient digital skills was also found useful in supporting older adults' self-efficacy and mitigating their negative attitudes toward technology or themselves when interacting with technology. Similarly, Wynia Baluk et al. (2023) showed that older adults need training that is adaptable to their needs, to promote their confidence to use smart devices and e-services effectively. In addition, the results of the quantitative study by Ha and Park (2020) found that positive attitudes toward technology represented a relatively more important factor than perceived ease of use or perceived usefulness in explaining the relationship with technology among a group of older adults. Therefore, as indicated by the present findings, it is necessary to build positive attitudes among older adults via proper support services.

Our findings also add to the body of the literature that some older adults regardless of their educational backgrounds are ready to welcome the real-time support provided by assistive technologies, such as chatbots when the task is not very complex or related to critical issues. Providing real-time support could help them control their stress and fear while using a smart device or completing an online task. Chatbots could also aid older adults with cognitive issues in recalling details while performing tasks online. For example, a bot could be installed on smart devices and operated through voice commands. When individuals need assistance, they can activate the bot and request help. Several studies have confirmed the usefulness of chatbots for older adults in different contexts. For example, Gudala, Ross, Mogalla, Lyons, Ramaswamy, and Roberts (2022) showed that the acceptance of voice-based chatbots could lead to various benefits for older adults and help them overcome visual and dexterity impediments while using smart devices and e-services. Similarly, Aggarwal, Tam, Wu, Li, and Qiao (2023) revealed that Artificial intelligence (AI) chatbots could offer a nonjudgmental space for communicating sensitive information. Furthermore, other forms of real-time support were suggested by the participants, such as hotlines operated by humans for important subjects, or visual tours for the public e-services.

In addition to providing older adults with different types of support services, our findings emphasized the significance of user-friendly designs in supporting older adults' use of smart devices and e-services. This design approach was suggested as useful in mitigating the perceived feeling of complexity regarding smart devices and e-services as a significant issue hindering older adults' sustained use of smart devices and e-services, similar to other research works (Ejdys & Gulc, 2022; Hänninen et al., 2021; Schreurs et al., 2017; Suopajärvi, 2015). We confirm previous findings that involving older adults, their needs or experiences in the design process could improve digital inclusion, as people find the tools easy to interact with and relevant to their needs (Holthe, Halvorsrud, & Lund, 2022; Ma, Chan, & Teh, 2021). The suggested usability improvements, in this study, were primarily related to improving communication functions. This is not surprising, considering that the participants mainly used smart devices and e-services for communication reasons. For example, a larger microphone button on smartphones was suggested to make sending audio messages easier. Larger buttons are more easily recognizable by older adults and accommodate physical challenges such as impaired vision and hand tremors.

We found that when the user-friendly tools come with proper instructions in multi-media forms, such as short videos, audio files, road maps, and easy-to-read texts with pictures, older adults feel more supported to use. Suitable instructions and a user-friendly design were identified as useful in mitigating problems related to the complexity of smart devices and e-

services and the negative attitudes toward them. Although the need for proper instructions has been discussed frequently in previous studies (Harris, Blocker, & Rogers, 2022; Kaihlanen et al., 2022; Mahroo, Greci, Mondellini, & Sacco, 2023; Tang et al., 2022; Xie et al., 2020), it seems that the available support and instructions are still not adequate or appropriate for all groups of users. Therefore, service designers should focus more on finding solutions to make the instruction more practical and efficient. We suggest using older people's direct insights in the design process of instructions.

Moreover, our findings confirm previous studies that to ensure older adults' sustained use of smart devices and e-services, it is essential to support their motivation (van Velsen, Broekhuis, Jansen-Kosterink, & Op den Akker, 2019). We added to this finding that motivational factors might differ for older adults with different backgrounds. Older adults with low education backgrounds might feel motivated to use the tools when they receive information regarding the tools, their benefits, and their functionalities. For example, when they know how to manage their health issues online independently, they will be motivated to use such tools. Friends were, on the other hand, identified as an effective factor in maintaining motivation among older adults with high educational backgrounds, to use smart devices or e-services.

Moreover, our findings showed that social expectations can influence older adults' relationship with technology in both positive and negative ways. When older adults are expected to use technology without being pressured to learn it too quickly or being underestimated due to their slow learning and use process, they are more likely to feel encouraged to engage with smart devices and e-services. Similarly, other studies showed that older adults often develop strategies to adapt and fit in when societal norms emphasize being capable users of new technologies (Jaschinski, Ben Allouch, Peters, Cachucho, & van Dijk, 2021). Therefore, we recommend realigning social norms and expectations to foster technology use within this demographic. To do so, it is necessary to accept that older adults need specific types of education and longer periods to learn to handle smart devices and e-services. The responsibility of realigning social norms and providing older adults with proper education is on various societal sectors, including authorities (e.g. governments, local community centres), educational institutions, and tech companies. Adequate funding and policy support are essential to scale these efforts.

CONCLUSIONS

The findings of this study suggest that while there is no concrete answer to enhancing digital inclusion for older adults, a combination of practical solutions could effectively support their inclusion. Our findings suggest that future designs or updates of smart devices and e-services should have user-friendly interfaces that address the needs, expectations, and emotions of older adults. By being mindful of older adults' needs, manufacturers, service providers and developers can make more informed design decisions. We suggest that these tools should also be accompanied by additional support services, such as clear instructions in multimedia formats and real-time assistance features, such as chatbots and hotlines.

Moreover, to bridge the digital divide between generations, public decision-makers and authorities should take several actions. First, offering older adults personalized education

concerning their digital skills, self-efficacy and emotions toward technology, as well as themselves when interacting with the available technology. Second, identifying and implementing factors that support older adults' motivations. The motivational factors vary widely within this demographic based on their background, necessitating the identification and implementation of diverse strategies tailored to individual needs. Lastly, social norms should be adjusted to foster a more supportive environment for technology use among older adults.

However, this study identified the potential solutions to address the challenges, but it did not address practical implementation strategies. For example, we found that multiple factors could support older adults' motivation to use smart devices and e-services, but for inquiring into those factors in detail, additional studies are needed. This gap underscores the need for further research. This study faced other obvious limitations. For example, the participants did not represent the entire population of older adults. The interviewees were people who had previous experience of using at least one smart device or e-service, and they were recruited at the main public library in Turku. Therefore, only relatively healthy and active older adults were included in the study. Those who were unable to leave their homes or care facilities and those without previous experience using smart devices and e-services were excluded. A study with a larger sample of older adults from a broader variety of backgrounds is needed to identify population-level trends concerning the issues discussed in this article. Another limitation is the lack of focus on a specific smart device or e-service. We allowed participants to discuss the most important challenges and potential solutions related to any type of smart device or e-service. Future studies should focus on specific tools to collect more specified data.

IMPLICATIONS FOR THEORY, APPLICATION, OR POLICY

This study highlights the importance of considering vulnerable users' viewpoints regarding the solutions supporting their sustained interaction with technology. The findings reveal that incorporating users' contributions goes beyond integrating their experiences into the design of technology; it also involves addressing their feelings, motivational factors and needs for support to use various tools. We underline the importance of real-time support provided by assistive technologies, like chatbots in older adults' sustained use of technology and addressing challenges for non-critical issues. It is anticipated that tools with bot assistants will support older adults in managing real-time issues that cause stress or fear and help them recall details needed to complete online tasks. Moreover, the dual effect of social expectations on older adults' digital inclusion underscores the importance of realigning fair social norms. Achieving these goals requires the collaboration of multiple parties in society, such as societal stakeholders, service designers, service providers, and families.

Declaration of interest statement

The authors declare that they have no conflicting interests.

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